

# The Hazard of Sporadic Meteoroids to Commercial Aircraft

## Overview

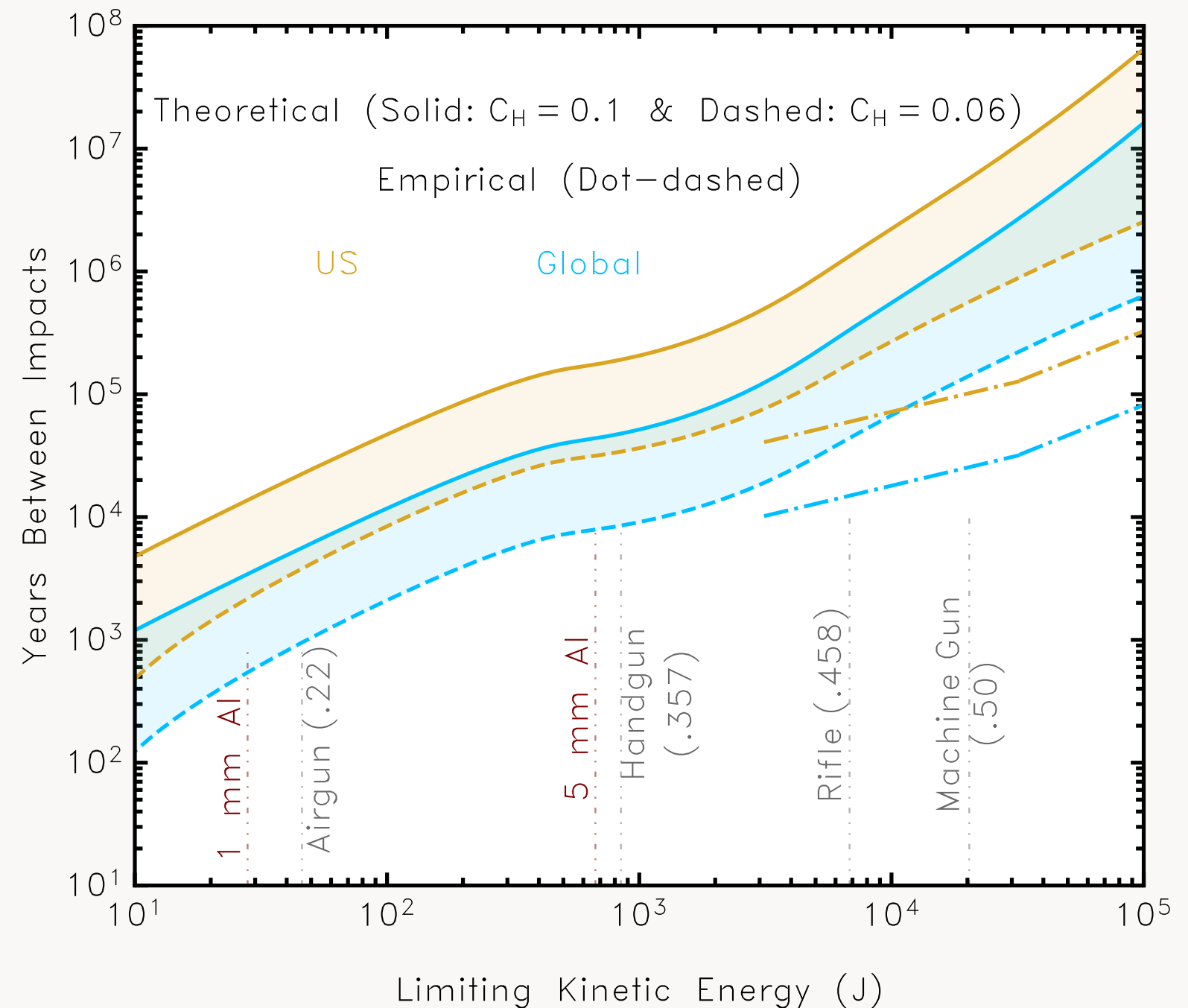
- ▶ The hazard of sporadic meteoroids to commercial passenger aircraft is derived using a meteoroid ablation model, empiric information on meteoroid entry frequencies and archival data on airborne aircraft.
- ▶ Single-body ablation is used to deduce the risk for a density ( $3,600 \text{ kg m}^{-3}$ ) that embodies the predominant risk from the high-density population of sporadic meteoroids and the majority of meteorites.
- ▶ The analysis reassures those alarmed of a meteoroid impact on their next flight.

## Exemplar Hazards

Some representative hazards to US commercial passenger aircraft for limiting impact kinetic energies:

- ▶ *1 mm Airplane Skin (28 J)*: meteoroid impact once every 2,170 to 13,800 years.
- ▶ *.22 Airgun (46 J)*: average time between meteoroid impacts is 3,800 to 22,500.
- ▶ *5 mm Airplane Skin (670 J)*: mean time between impacts is 31,500 to 175,000 years.
- ▶ *.36 Handgun (850 J)*: impact frequency of meteoroids is 34,000 to 190,000 years.
- ▶ *Between .46 Rifle and .50 Machine Gun ( $10^4 \text{ J}$ )*: impact frequency lies between 70,000 to 1 million years.

## Number of Years Between Meteor Impacts as a Function of Limiting Kinetic Energy



The sporadic meteoroid hazard to US (gold) and global (blue) commercial passenger aircraft is illustrated above. The theoretical and empirical estimates form a delimited hazard for energies above 3,000 J. Critical penetration energies for 1 mm and 5 mm sheets of aluminum (of which most planes are made) are shown in maroon. Vertical perforations (gray) delineate kinetic energies of popular projectiles.